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Indian Standard

METHODS FOR DETERMINATION OF COLOUR FASTNESS OF TEXTILE MATERIALS TO DOMESTIC AND COMMERCIAL LAUNDERING

UDC 677·016·474 : 535·685·2

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BUREAU OF INDIAN STANDARDS
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Chemical Methods of Test Sectional Committee, TXD 5

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft/finalized by the Chemical Methods of Test Sectional Committee had been approved by the Textile Division Council.

A large number of domestic and commercial laundering procedures for textiles are prevalent in use which normally employ the use of a large variety of synthetic detergents. The colour fastness depends to a large extent on the nature of process and chemicals used for domestic and commercial laundering. The methods given in this standard are intended to reflect the effect of comprehensive laundering by either domestic or commercial procedures as distinct from the washing test methods given in:

a) IS 687 : 1979 Method for determination of colour fastness of textile materials to washing: Test 1 (*second revision*)

b) IS 764 : 1979 Method for determination of colour fastness of textile materials to washing: Test 3 (*second revision*)

c) IS 765 : 1979 Method for determination of colour fastness of textile materials to washing: Test 4 (*second revision*)

d) IS 3361 : 1979 Method for determination of colour fastness of textile materials to washing: Test 2 (*first revision*)

e) IS 3417 : 1979 Method for determination of colour fastness of textile materials to washing: Test 5 (*first revision*)

In the preparation of this standard considerable assistance has been derived from ISO 105-1982 'Textiles — Tests for colour fastness — C06 Colour fastness to domestic and commercial laundering', issued by the International Organization for Standardization (ISO).

Indian Standard

METHODS FOR DETERMINATION OF COLOUR FASTNESS OF TEXTILE MATERIALS TO DOMESTIC AND COMMERCIAL LAUNDERING

1 SCOPE

1.1 This standard prescribes methods for determination of colour fastness of textile materials of all kinds and in all forms to domestic or commercial laundering procedures used for normal household articles. Industrial and hospital articles may be subjected to special laundering procedures which may be more severe in some respects.

1.2 The colour loss and staining, resulting from desorption and/or abrasive action in one 'S' test closely approximates to one commercial or domestic laundering. The results of one 'M' test may in some cases be approximated by the results of up to five domestic or commercial launderings at temperatures not exceeding 70°C. The 'M' tests are more severe than the 'S' tests because of an increase in mechanical action.

1.3 These methods do not reflect the effect of optical brighteners present in commercial washing products.

2 REFERENCES

2.1 The following Indian Standard is a necessary adjunct to this standard:

IS No.	*Title*
1070 : 1977	Specification for water for general laboratory use (*second revision*)

3 PRINCIPLE

3.1 A specimen of the textile in contact with specified adjacent fabric or fabrics is laundered, rinsed and dried. Specimens are laundered under appropriate conditions of temperature, alkalinity, bleaching and abrasive action such that the result is obtained in a conveniently short time. The abrasive action is accomplished by the use of a low liquor ratio and an appropriate number of steel balls. The change in colour of the specimen and the staining of the adjacent fabric or fabrics are assessed with the grey scales.

4 SAMPLING

4.1 Sample to determine conformity of a lot to this specification shall be selected so as to be representative of the lot.

4.2 Sample drawn in compliance with the relevant material specification or as agreed to between the buyer and the seller shall be held to be representative of the lot.

5 APPARATUS

5.1 Suitable Mechanical Device

This consists of a water bath containing a rotatable shaft which supports, radially, stainless steel containers 75 ± 5 mm diameter × 125 ± 0 mm high and of capacity 550 ± 50 ml, the bottom of the containers being 45 ± 10 mm from the centre of the shaft.

The shaft container assembly is rotated at a frequency of 40 ± 2 per minute. The temperature of the water bath is thermostatically controlled to maintain the test solution at a prescribed temperature ±2°C.

NOTE — Other mechanical devices may be used for this test, provided that the results are identical with those obtained by the apparatus described in **5.1**.

5.2 Non-corredible (Stainless) Steel Balls, approximately 0·6 cm in diameter.

5.3 Two Standard Single-Fibre Adjacent Fabrics

One of the same fibre (or the predominant fibre in the case of blends) as the fabric under test and the second made of the fibre specified below or as otherwise specified:

If the First Piece is	**The Second Piece to be**	
	For tests A and B	For tests C, D and E
Cotton	Wool	Viscose
Wool	Cotton	—
Silk	Cotton	—
Viscose	Wool	Cotton
Linen	Wool	Viscose
Acetate and triacetate	Viscose	Viscose
Polyamide	Wool or cotton	Cotton
Polyester	Wool or cotton	Cotton
Acrylic	Wool or cotton	Cotton

5.3.1 *A Standard Non-dyeable Fabric*, For example, polypropylene, if required.

5.4 Flat-Iron

Flat-iron, in case required for pressing treatment, shall have mass not exceeding 2·5 kg and capable of giving the temperature indicated in **8.9** (b).

5.5 Grey Scales for Assessing Change in Colour and Staining

6 REAGENTS

6.1 Quality of Reagents

Unless otherwise specified, pure chemicals and distilled water (*see* IS 1070 : 1977) shall be used for the tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the test results.

6.2 Detergent

Detergent shall be without optical brightener, having one of the compositions given in **6.2.1** or **6.2.2**.

6.2.1 ECE Reference Detergent with the following composition:

	Composition as such % (*m/m*) (± 0·02%)
Linear sodium alkyl benzene sulphonate (mean length of alkane chain C 11·5)	8·0
Ethoxylated tallow alcohol (14 EO)	2·9
Sodium soap; (chain length) C_{12}-C_{16} : 13-26 % C_{18}-C_{22} : 74-87 %	3·5
Sodium tripolyphosphate	43·7
Sodium silicate ($SiO_2/Na_2O=3{\cdot}3/1$)	7·5
Magnesium silicate	1·9
CMC (Carboxymethylcellulose)	1·2
EDTA sodium salt	0·2
Sodium sulphate	21·2
Water	9·9
	100·0

6.2.2 *AATCC Reference Detergent WOB*

With the following composition:

The detergent is low sudsing; the surfactants composing the detergent are anionic with a small proportion of nonionic. They are bio-degradable.

Nominal Composition	% (*m/m*) (± 0·02 %)
Linear alkylate sulphonate, sodium Salt (IAS)	14·00
Alcohol ethoxylate	2·30
Soap—high molecular mass	2·50
Sodium tripolyphosphate	48·00
Sodium silicate ($SiO_2/Na_2O=2{\cdot}0$)	9·70
Sodium sulphate	15·40
CMC (Carboxymethylcellulose)	0·25
Water	7·85
	100·00

NOTE — In cases where perborates are used in laundering, the ECE reference detergent without optical brightener may be used.

6.3 Sodium Carbonate (Na_2CO_3) — if required.

6.4 Sodium Hypochlorite

NOTE — The *p*H value and available chlorine content of a large number of trade named products of sodium hypochlorite (NaOCl) vary from *p*H 9·8 to 12·8 and Cl_2 content from 14 to 16 percent (*m/m*). The actual available chlorine shall be determined before use and the following method is suggested.

Pipette 1·00 ml of the stock sodium hypochlorite solution into a conical flask and dilute to 100 ml with distilled water. Add 20 ml of 294 g/l sulphuric acid (H_2SO_4) solution and 6 ml of 120g/l potassium iodide (KI) solution. Titrate with standard volumetric sodium thiosulphate solution ($Na_2S_2O_3 .5H_2O$) = 0·1 mol/l.

The available chlorine (Cl_2) content is given as a percentage by mass, by the formula:

$$\frac{V\times c\times 0{\cdot}035\,5}{V_0\times d_0}\times 100$$

where

V_0 = the volume in millilitres, of sodium hypochlorite solution taken;

d_0 = the density, in grams per millilitre, of the sodium hypochlorite solution;

V = the volume, in millilitres, of sodium thiosulphate solution used; and

c = the concentration of the amount of substance, in moles per litre, of the sodium thiosulphate solution.

6.5 Sodium Perborate Tetrahydrate ($NaBO_3.4H_2O$)

6.6 Distilled water (*see* IS 1070 : 1977)

6.7 Acetic Acid Solution—Containing 0·2 g of glacial acetic acid per litre; if required for scouring treatment.

7 PREPARATION OF TEST SPECIMENS

7.1 If the textile to be tested is fabric, attach a specimen 10 cm × 4 cm between the two single fibre adjacent fabrics (*see* **5.3**) by sewing along one of the shorter edges.

7.2 Yarn may be knitted into fabric and tested in this form. Where yarns or loose fibres are to be tested, take a mass of the yarn or loose fibre approximately equal to one-half of the combined mass of the adjacent fabrics and place it between 10 cm × 4 cm pieces of the two specified standard single-fibre adjacent fabrics (*see* **5·3**) and sew them along all four sides.

8 TEST PROCEDURES

8.1 Prepare the wash liquor by dissolving 4 g of detergent per litre of distilled water. For all C, D or E tests, adjust the *p*H as stated in Table 1 by the addition of approximately 1 g of sodium carbonate per litre of solution. The liquor should be cooled to 27°C befor the *p*H is measured For the A and B tests, no adjustment of *p*H is required.

8.2 For tests where perborate is employed, prepare the washing solution containing perborate at the time of use by heating the liquor to a maximum temperature of 60°C for not more than 30 min.

8 3 For tests D3S and D3M, add to the wash liquor sufficient sodium hypochlorite solution to provide the concentration of available chlorine specified in Table 1.

8.4 Add to each container the volume of wash liquor specified in Table 1 so as to give liquor ratio of 50:1. Except for tests D2S and E2S, adjust the temperature of the liquor to within ± 2°C of the specified temperature and then place in the container the specimen together with the specified number of steel balls. Close the container and operate the machine at the temperature and for the time specified in Table 1.

8.5 For tests D2S and E2S, place the specimen in the container at a temperature of approximately 60°C, close the container and raise the temperature to within ±2°C of the specified temperature in not more than 10 min. Begin timing the test as soon as the container is closed. Operate the machine at the temperature and for the time specified in Table 1.

8.6 For all tests, remove the composite specimen, rines it twice in cold distilled water and then in cold running tap water for 10 min. and squeeze it.

8.7 When the material is to be soured at the end of the washing operation, the following optional operation may be conducted:

> Treat each composite specimen in the acetic acid reagent (*see* **6.7**) for 1 min at 30°C at liquor ratio of 50 : 1. Then rinse the composite specimen as prescribed in **8.6** and squeeze it.

8.8 For all methods, extract the excess water from the composite specimens.

8.9 For all methods, dry the specimen by one of the following procedures:

a) By hangingit in air, in shade at a temperature not exceeding 60°C with the parts in contact only at the line of stitching.

b) When the fabrics are to be dried by pressing, each specimen may be dried by pressing it with the flat-iron (*see* **5.4**) at the temperature appropriate to the fabric under test, but in no case at a temperature above 150°C, with adjacent fabric uppermost and in contact with the face of the specimen.

8.10 Assess the change in colour of the specimen and the staining of the adjacent fabrics using the grey scales.

NOTE — In cases of doubt in the colour fastness ratings as assessed by an observer, the assessment should be done by at least three observers and the overall average rating should be reported.

9 REPORT

9.1 The test report shall include the following information:

a) The numerical ratings for the change in colour of the specimen and for the staining of the adjacent fabric(s) used;

b) The number of method of test used (as listed in Table 1);

c) Whether steel balls have been used in some of the A or B tests;

d) Whether the treatment in the acetic acid reagent described in **8.7** was conducted;

e) Whether the specimen was air-dried or dried by pressing as described in **8.9**; if dried by pressing, the temperature of the pressing treatment shall be reported;

g) Whether the AATCC Reference Detergent WOB or the ECE Reference Detergent witout optical brightener, was used.

Table 1 Conditions of Treatment
(*Clauses* 8.1, 8.3, 8.4 *and* 8.5)

Test No.	Temperature °C	Available Chlorine %	Sodium Perborate g/l	Time min	Steel Balls	Adjust *p*H to
A1S	40	None	None	30	10*	Not Adjusted
A1M	40	None	None	45	10	Not Adjusted
A2S	40	None	1	30	10*	Not Adjusted
B1S	50	None	None	30	25*	Not Adjusted
B1M	50	None	None	45	50	Not adjusted
B2S	50	None	1	30	25*	Not adjusted
C1S	60	None	None	30	25	10·5 ± 0·1
C1M	60	None	None	45	50	10·5 ± 0·1
C2S	60	None	1	30	25	10·5 ± 0·1
D1S	70	None	None	30	25	10·5 ± 0·1
D1M	70	None	None	45	100	10·5 ± 0·1
D2S	70	None	1	30	25	10·5 ± 0·1
D3S	70	0·015	None	30	25	10·5 ± 0·1
D3M	70	0·015	None	45	100	10·5 ± 0·1
E1S	95	None	None	30	25	10·5 ± 0·1
E2S	95	None	1	30	25	10·5 ± 0·1

*For delicate fabrics and articles of wool or silk or blends containing these fibres, steel balls are not used in the test. Record the use of steel balls in the test report [*see* 9.1 (c)].

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